IJBC 2013;6(1): 27-31

Reviewing the Blood Ordering Schedule in a Tertiary Trauma Center

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Submitted: 13-02-2013 , Accepted: 21-09-2013

Abstract

Background: To evaluate the present status of blood utilization and develop practice guidelines in teaching hospitals in Northern Iran.

Methods: We retrospectively analyzed the amount of blood prepared and used preoperatively for 11 elective procedures, from March 2010 to March 2011 in teaching hospitals in Northern Iran. Study variables included the crossmatch transfusion ratio, the transfusion index and transfusion probability. The crossmatch transfusion ratio and the transfusion index were also calculated for each type of elective surgery performed during the study period.

Results: During the study period, 5981 units of blood were crossmatched for 1970 cases. Out of these1835 units of blood were transfused which means only 31% of blood was utilized while 69% was not needed. The overall crossmatch transfusion ratio for 11 procedures was 31.1 and many procedures were found to have a high transfusion ratio and a low transfusion index.

Conclusion: The introduction of maximum surgical blood-order schedule will lead to a reduction of blood outdating and crossmatch workload. Although routine cross match seems necessary for two elective surgical procedures (coronary artery bypass graft and hysterectomy); in vast majority of elective surgical procedures type and antibody screening is recommended.

Keywords: Blood, transfusion, crossmatch, ratio, probability, index.

Introduction

The increasing demand for blood and blood products together with rising costs is a major health care problem. Previous studies have indicated gross over ordering of blood much in excess of actual needs [1]. In Iran as a whole, blood donation is voluntary and blood and its components may not be a source of profit. Also most of the blood transfusion services in Iran are not regularly screening the blood for atypical antibodies.

It Seems there are two reasons for over ordering of blood in hospitals. First is the growing real demand for blood. Iran is currently passing through an epidemiological transition, where communicable diseases have begun to decline; but non-communicable diseases are now appearing as major causes of death. For the population as a whole, the primary causes of mortality are cardiovascular diseases, unintentional injury, and cancer [2]. The second reason is that most of the surgeons and anesthetists over order blood for specific recipients, because they are not sure about easy access to blood when it is needed. Therefore it is held in a reserved status for that person and could not be used for other patients. Furthermore some of them routinely arrange two units of blood for each surgical procedure. In practice, such blood may become outdated during reserved period. In hospitals of Northern Iran, this reserved period is usually 48 to 72 hours. This study aimed to audit the blood utilization in elective surgeries in teaching hospitals of Rasht city in Northern Iran and formulate a maximum surgical blood-order schedule (MSBOS). The term MSBOS has been used to describe a list of common elective surgeries with the maximum number of units of blood to be crossmatched preoperatively [3-6] .The principal aim

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Table 1: Elective surgical procedures 2010-211: distribution by mean age and gender ratio.

Operations	Number of cases	Mean age	Male/Female ratio
CABG*	400	59.86	1.6
Hysterectomy	240	47.94	0
Adenotonsillectomy	205	12.6	1.1
Children's Hernia	131	1.5	4.9
Gastrectomy	33	63.8	3.7
Cholecystectomy	209	55.66	0.5
Mastectomy	61	44.8	0.1
Adult Hernia	164	55.2	81
Colectomy	112	59.6	1.2
Craniotomy	240	44	3.4
Vascular surgery	121	55.1	2

* Coronary Artery Bypass Graft surgery.

of this study was to identify the surgical procedures where type and antibody screen can be introduced and to formulate a maximum surgical blood-order schedule for those procedures where a complete crossmatch appears mandatory.

Materials and Methods

This was a descriptive, retrospective study of blood ordering routines and utilization for elective surgical procedures occurring in teaching hospitals of Guilan province from 20 March 2010 through 20 March 2011. Guilan province is located in Northern Iran bordering the Caspian sea with a population of about 2.5 million residents. In the present study 1917 patients undergoing 11 most frequent surgical procedures were observed. All requests of blood for elective surgery during this period were recorded. This study used blood transfusion request data furnished by hospital's blood bank records. Outcome measures used in this study were the crossmatch transfusion ratio (C/T ratio) and the transfusion index (TI).

The crossmatch transfusion ratio = No. of units cross-matched /No. of units transfused. A ratio of 2.5 is indicative of significant blood utilization. This ratio is used as a measure of the efficiency of blood ordering practice. The transfusion index (TI) = No. of units transfused/No. of units crossmatched. A value of 0.5 is considered indicative of significant blood utilisation[7-8]. The C/T ratio and the TI were calculated for each type of elective surgery performed during the study period.

Transfusion Probability (T%) = No. of patients transfused/No. of patients crossmatched*100. A value of 30 is considered indicative of significant blood utilization.

An estimation of the number of blood units which needs to be cross matched preoperatively for each procedure was derived using the simplest form of Mead's criterion using the following formula [9-10]:

MSBOS = 1.5 x TI where, TI = Number of units transfused/Number of units crossmatched.

Results

Overall, during the study period, 5981 units of blood were cross-matched for 1917 patients and 1835 units of blood were transfused. This means that only 31% of blood was utilized while 69% was not needed. The elective operative procedures observed in this study are listed in table 1. Out of the total observed cases 43 % were from the general surgery departments, 21% from heart surgery departments, 13% from obstetrics and gynecology departments, 10.6% from ENT units and 13% from neurosurgical units. The study data documented a male-female ratio of 1.2:1(1061 male with 55.3% and 856 female with 43.7%).

The overall C/T ratio for 11 procedures was 31.1. The results of the study were divided into three groups. When assessing groups against study measures, we found that the C/T ratio for procedures Coronary Artery Bypass Graft (CABG) and hysterectomy in group I were below 2.5, and the transfusion index (TI) was in excess of 0.5 which confirmed the significant blood usage.

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Table 2: Blood data for elective surgical procedures, 2010-211.

Groups	Operations	Number of cases	Patients Cross Matched vs. Patients Given Transfusions	Units Cross Matched (C) vs. Units Transfused (T) (C-T Ratio)	Transfusion Index
I	CABG*	400	1.02	1.26	3.55
	Hysterectomy	240	2.6	2.46	0.82
II	Gastrectomy	33	5.5	14.6	0.39
	Cholecystectomy	209	3.7	7.1	0.34
	Colectomy	112	5.9	13.7	0.037
III	Adenotonsillectomy	205	34.1	51.2	0.03
	Children's Hernia	131	6.9	6.1	0.16
	Mastectomy	61	62	152	0.01
	Adult Hernia	164	7.8	13.8	0.14
	Craniotomy	240	20	59.6	0.07
	Vascular surgery	121	6.7	17	0.15

Groups II to III procedure gave different results, 3 of the 9 elective procedures had a very high C/T ratio, namely craniotomy, mastectomy and adenotonsillectomy exceeding 50. It seems that a large quantity of blood ordered in these groups was crossmatched preoperatively for these patients but most of units were held in reserve.

Applying Mead's criterion against the number of units to be crossmatched provided an estimated crossmatching need of 5 blood units for CABG and 2 units for hysterectomy in group I, one unit for procedures in group II and no blood to be prepared for procedures in group III.

Discussion

It has been shown that in the absence of a Maximum Blood Ordering Schedule, there is a high surge in additional costs to the patient, rise in the amount of blood that is outdated and an increase in blood transfusion centers' workload [11-14]. The MSBOS is found to be effective if there is a regular screening of blood for atypical antibodies or the usage of blood and blood products are rationalized and they are saved for crisis situations. MSBOS formulation has been developed using Mead's criterion [8], According to this criterion, the number of RBCs calculated was one and half times the transfusion index for each surgical procedure. In our study 69% of the cross matches performed were found to be unnecessary. In general, it is troubling that the average C/T ratio for 11 elective surgical procedures in this study was 31.1, that is much higher than C/T ratio observed in high income countries, where there was an average C/T ratio of 4.1 in 1976 [15]. This is unacceptably high and means that the number of units cross matched is 31 times more than the number of units actually transfused. Such a C/T ratio found in this study is not even comparable to low-and middle- income countries in Asia [16-17]. This practice of ordering was probably because of the fear that blood will not be available, if needed. Our findings shows that a large quantity of blood is ordered in groups II and III but very little is used and none is required in group III. Previous data has demonstrated that vascular procedures have a C/T ratio below 5 and a transfusion index in excess of 0.5 [18]. This is not in accordance with our study data where a high C/T ratio of 17 and TI ratio of 0.15 is present. The main reason is that major vascular surgical procedures are not performed in this study's area.

According to the report of Boral and Henry which was based on Mead's criterion [7], if a procedure uses <0.5 units of blood per procedure, as noted in group III in this study, a pre-operative cross-match is not appropriate. One should implement ABO grouping and typing and screening, preferably before hospitalization. Then a "rapid spin cross-match" will be suggested if the antibodies are negative. Other procedures, i.e.; in groups I to II should have specific number of units prepared rather than leaving the decision to the individual surgeon. However, one must confirm the availability of blood for emergency situation before starting the surgery.

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Table 3: Recommended blood units to be crossmatched preoperatively.

Groups	Operations	Number of cases	Units transfused	*Mead's Criterion	Recommended units
I	CABG*	400	1420	5.3	5
	Hysterectomy	240	197	1.2	2
II	Gastrectomy	33	13	0.6	1
	Cholecystectomy	209	72	0.5	1
	Colectomy	112	42	0.5	1
III	Children's Hernia	131	21	0.24	0
	Adult Hernia	164	24	0.2	0
	Vascular surgery	121	19	0.2	0
	Craniotomy	240	18	0.1	0
	Mastectomy	61	1	0.02	0
	Adenotonsillectomy	205	8	0.06	0

*Mead's Criterion: average number of units transfused ×1.5= number of units to be crossmatched.

Conclusion

The introduction of maximum surgical blood-order schedule will lead to a reduction of blood outdating and crossmatch workload. Although routine cross match seems necessary for two elective surgical procedures (coronary artery bypass graft and hysterectomy); in vast majority of elective surgical procedures type and antibody screening is recommended.

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